X-space MPI: magnetic nanoparticles for safe medical imaging.

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Funding Grants: Magnetic Particle Imaging: A Novel Ultra-sensitive Imaging Scanner for Tracking Stem Cells In Vivo

Public Summary:
One quarter of all iodinated contrast X-ray clinical imaging studies are now performed on Chronic Kidney Disease (CKD) patients. Unfortunately, the iodine contrast agent used in X-ray is often toxic to CKD patients' weak kidneys, leading to significant morbidity and mortality. Hence, we are pioneering a new medical imaging method, called Magnetic Particle Imaging (MPI), to replace X-ray and CT iodinated angiography, especially for CKD patients. MPI uses magnetic nanoparticle contrast agents that are much safer than iodine for CKD patients. MPI already offers superb contrast and extraordinary sensitivity. The iron oxide nanoparticle tracers required for MPI are also used in MRI, and some are already approved for human use, but the contrast agents are far more effective at illuminating blood vessels when used in the MPI modality. We have recently developed a systems theoretic framework for MPI called x-space MPI, which has already dramatically improved the speed and robustness of MPI image reconstruction. X-space MPI has allowed us to optimize the hardware for fi ve MPI scanners. Moreover, x-space MPI provides a powerful framework for optimizing the size and magnetic properties of the iron oxide nanoparticle tracers used in MPI. Currently MPI nanoparticles have diameters in the 10-20 nanometer range, enabling millimeter-scale resolution in small animals. X-space MPI theory predicts that larger nanoparticles could enable up to 250 micrometer resolution imaging, which would represent a major breakthrough in safe imaging for CKD patients.

Scientific Abstract:
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